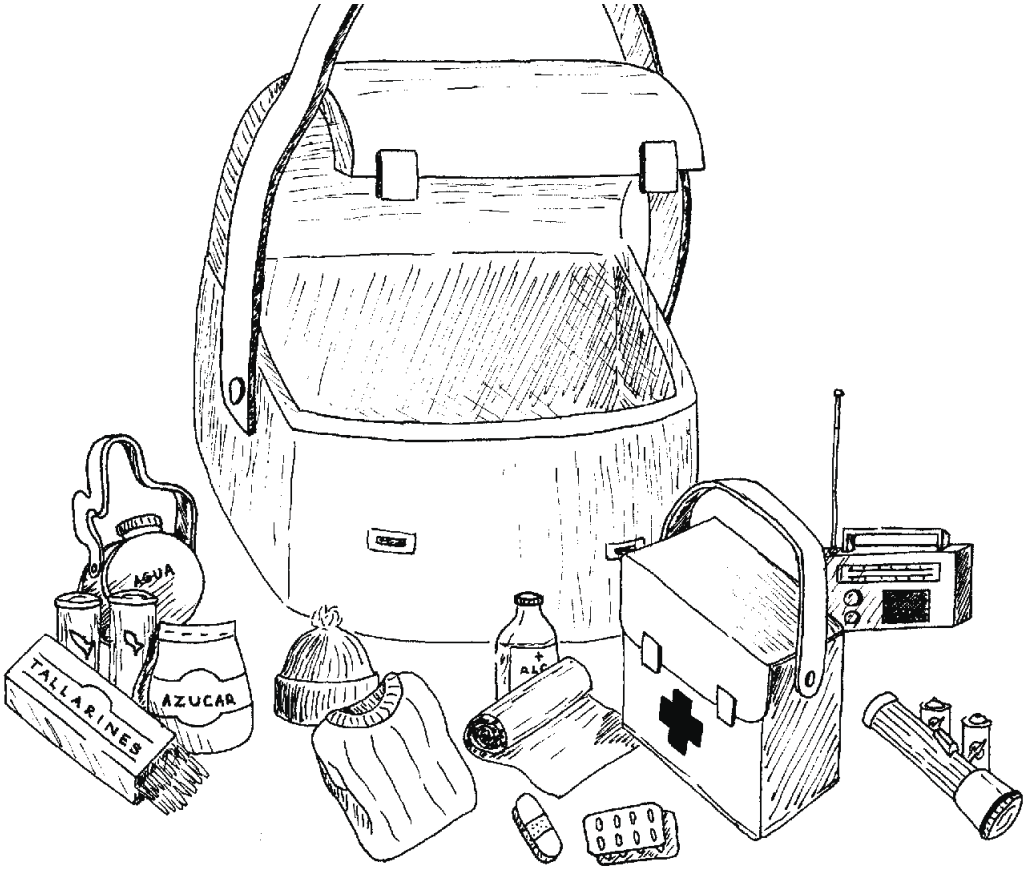
SURVIVAL KIT



CHAPTER 6

EARTHQUAKE AND TSUNAMI

PROTECTION MEASURES

- what to do before, during and after

Emergency preparedness is the collection of readiness activities undertaken by a community to maximize efficiency immediately prior to and during the emergency response period.

Because earthquakes strike without warning, it is important to act now. Knowing how to respond, and what to do, could save your life. The real cause of death or injuries during earthquakes is usually not the ground shaking. Most deaths are the result of collapsing buildings, falling debris, and objects like pieces of chimneys or ligths.

In the case of tsunamis, most of the victims arise from not knowing what to do or where to go if a tsunami is known to be coming.

This chapter lists a series of recommendations, for several settings, in case of an earthquakes and/or tsunami.

CHAPTER OBJECTIVES

1. Describe how to be prepared for the occurrence of a big earthquake.
2. Describe the actions to take during an earthquake to be safe from its effects.
3. Describe the actions to take after a big earthquake occurs.
4. Describe the actions to take in case of a tsunami.

6.1 WHAT TO DO BEFORE AN EARTHQUAKE

Unfortunately, earthquakes cannot yet be predicted. We don't know when and where the next one will occur. Because of this, all we can do during a period of quiescense is prepare ourselves by knowing what is expected to happen, and what to do before the earthquake in order to minimize loss of lives and damage to property.

BEFORE THE SHAKING STARTS..
PREPARE YOUR FAMILY!

6.1.1 Hazards most likely to occur:

a) Total or partial collapse of buildings.
b) Injury due to failing objects or debris.
c) Fires breaking out.
d) Electrocution due to breaking of power lines.
e) Gas explosion from gas line leaks.

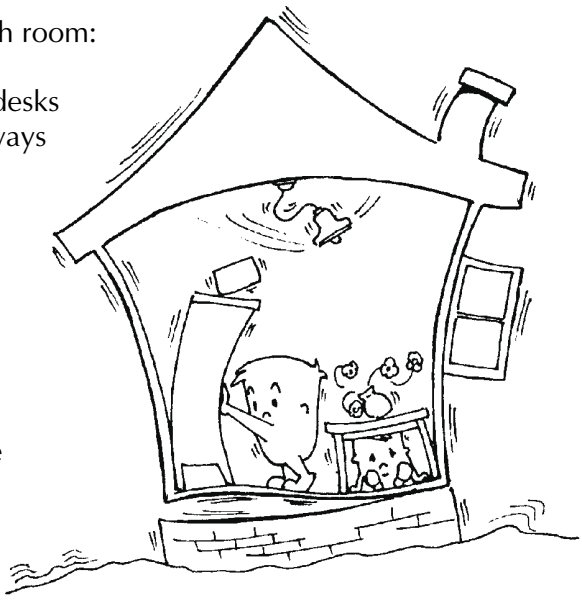
KNOW WHAT YOU HAVE TO DO
BEFORE YOU HAVE TO DO IT!

6.1.2 Actions to Take to Minimize Risk:

- Know the safe spots in each room:
  – against inside walls
  – under sturdy tables or desks
  – under supported doorways

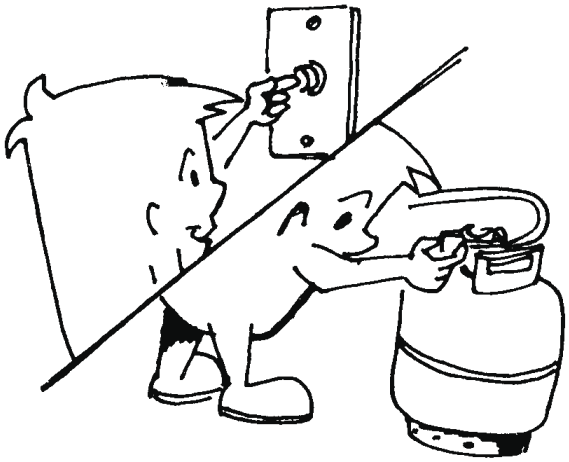
- Know the danger spots:

  – windows
  – mirrors
  – hanging objects
  – fireplace
  – tall unsecured furniture



- *Practice drills. Physically place yourself in safe locations. This is especially important for children to know and do.*

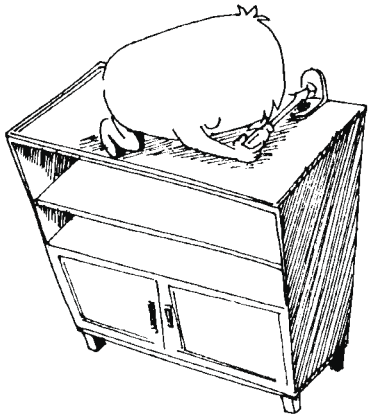
- *Learn first aid and cardiopulmonary resuscitation from your local Red Cross chapter or other community organization.*



- *Keep a list of emergency numbers.*

- *Learn how to shut off gas, water and electricity.*

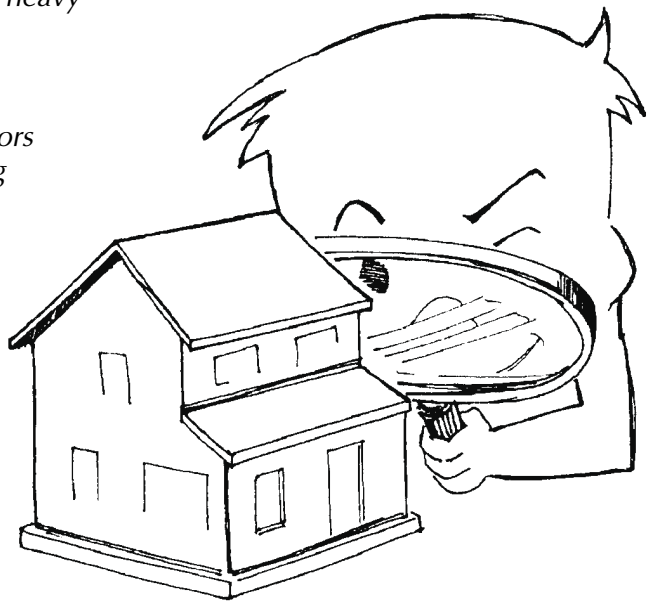
- *Keep breakables or heavy objects on bottom shelves.*



- *Secure tall, heavy furniture which could topple, such as bookcases, china cabinets, or wall units.*

- *Secure water heater and appliances which could move enough to rupture gas or electricity lines.*

- *Secure hanging plants and heavy picture frames or mirrors (especially over beds).*

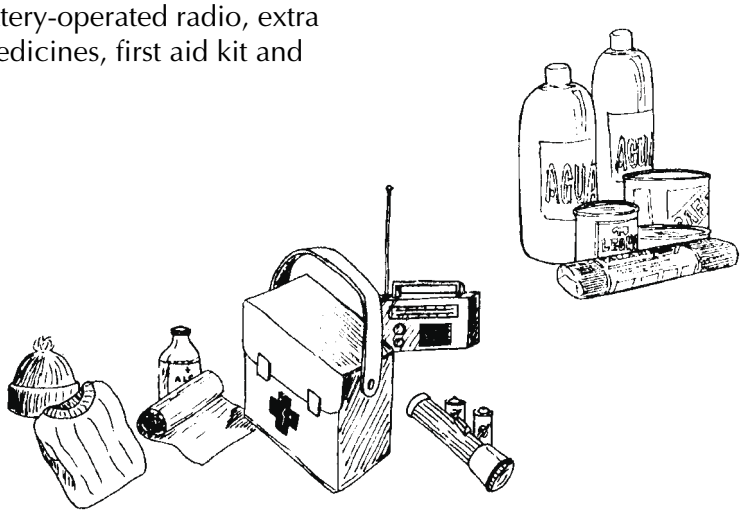


- *Put latches on cabinets doors to hold them closed during shaking.*

- *Keep flammable or hazardous liquids such as paints, pest sprays or cleaning products in the garage or outside shed.*

- *Check chimneys, roofs, walls, and foundation for structural condition.*

- Maintain emergency food, water and other supplies, including a flashlight, a portable battery-operated radio, extra batteries, medicines, first aid kit and clothing.



6.1.3 Guidelines for persons responsible for other groups of people.

For school authorities, factory and office heads, etc., the following actions are suggested even before the occurrence of an earthquake:

a) Persons should be assigned to make sure that electric power and gas lines are shut off immediately after the occurrence of an earthquake.

b) Predetermine the procedures to be used in vacating a big building where a large number of people are located.

c) Predetermine an open space where people from buildings should be moved.

d) Marshalls and guides should be assigned and trained to conduct the evacuation of the building.

e) Hospitals and other services especially needed during a disaster should have predetermined plans for establishment of these services outside of the original building in case of an earthquake disaster.

0 Drills should be conducted periodically to test plans and reaction in case of an earthquake.

g) Agencies in the locality needed for rescue or relief should be known beforehand so they may be contacted for assistance.

h) Keep abreast of the government warnings and instructions.

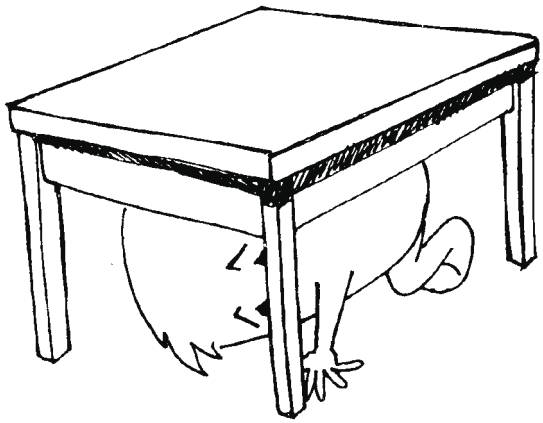
6.2 WHAT TO DO DURING THE SHAKING

DON'T PANIC!

The first thing is to react calmly. Although your reaction must be fast, you don't have to respond in a disorderly manner, because this is how panic is incited. Try to calm other people. Take care of children and elderly persons (some of whom may have physical problems).

6.2.1 Actions to Take to Minimize Risk:

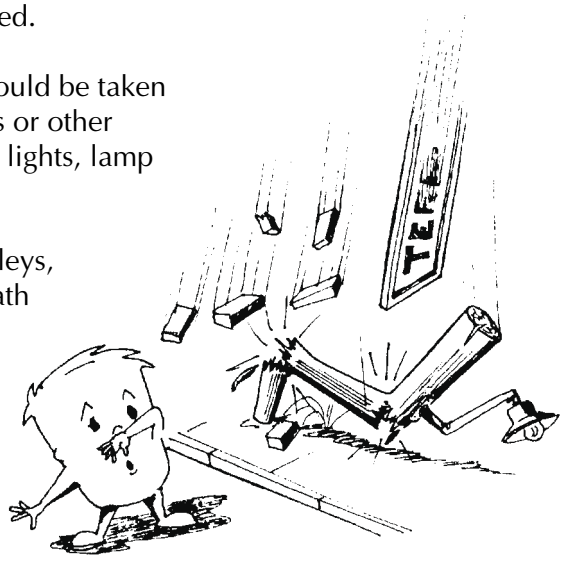
a) Open space is the safest location during a strong earthquake. Therefore, if open space is accessible within a few seconds, the first reaction is to go to the open. Many believe that the ground will open and swallow people, but this is not true.



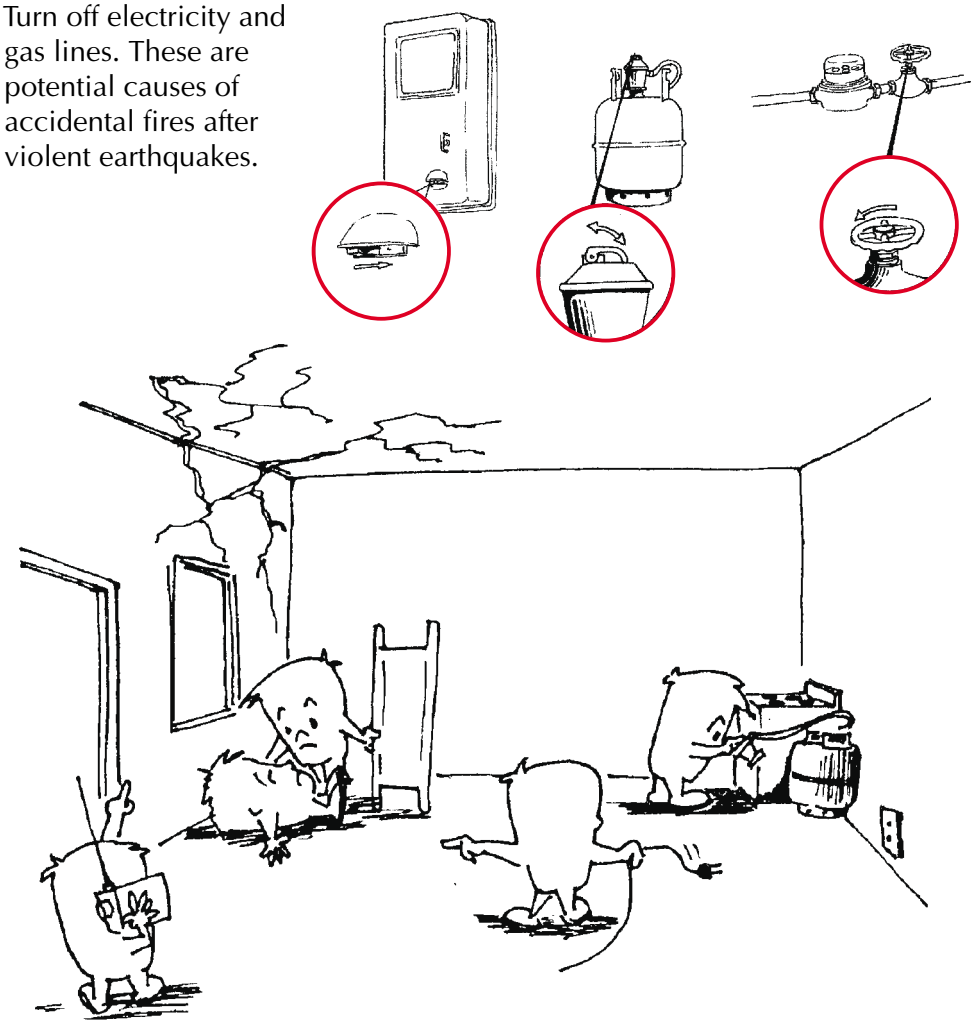
b) If access to the open is impossible within seconds, the next recommendation is to seek shelter under strong objects during the initial shaking. Immediately after the initial shaking, people should go to the open space until the seriousness of the destruction can be more completely evaluated.

c) If you are in the street, efforts should be taken to keep away from failling debris or other objects such as billboards, street lights, lamp posts, etc.

d) Avoid being caught in narrow alleys, between tall buildings, underneath electric wires, beneath overhanging structures or on steep embankments. There are usually hazards between highrise structures and on the embankments of rivers.

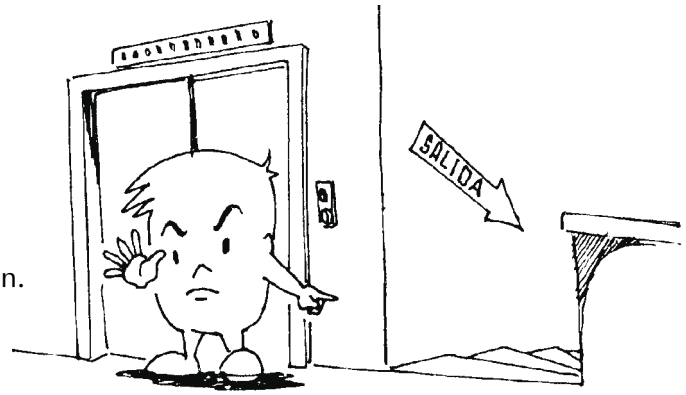


e) Turn off electricity and gas lines. These are potential causes of accidental fires after violent earthquakes.



f) Extinguish fires before you attempt to save lives. If this isn't done, an entire house or block of buildings may burn before anyone can be rescued.

g) Do not use elevators during or after the earhtquake until its safety is ascertained. After the violent shaking, elevators are usually jammed and short circuits may cause electrocution.

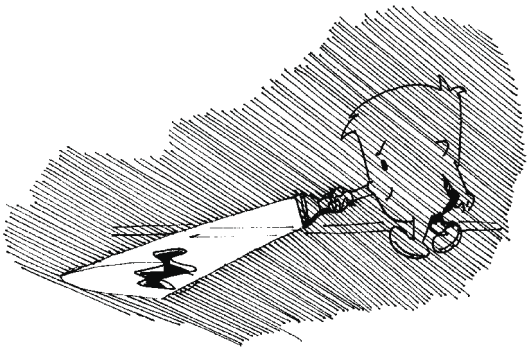


6.2.2 General tips for reducing danger in case of earthquakes.

a) Exercise care in the use of oil or kerosene lamps. These should be placed where there is no danger of their failling over and starting fires.

b) Do not sleep where tall, heavy furniture would hit you if it fell over. Any tall, heavy furniture should be anchored or tied down.

c) Do not store heavy objects on high shelves where they might fall and cause injury.

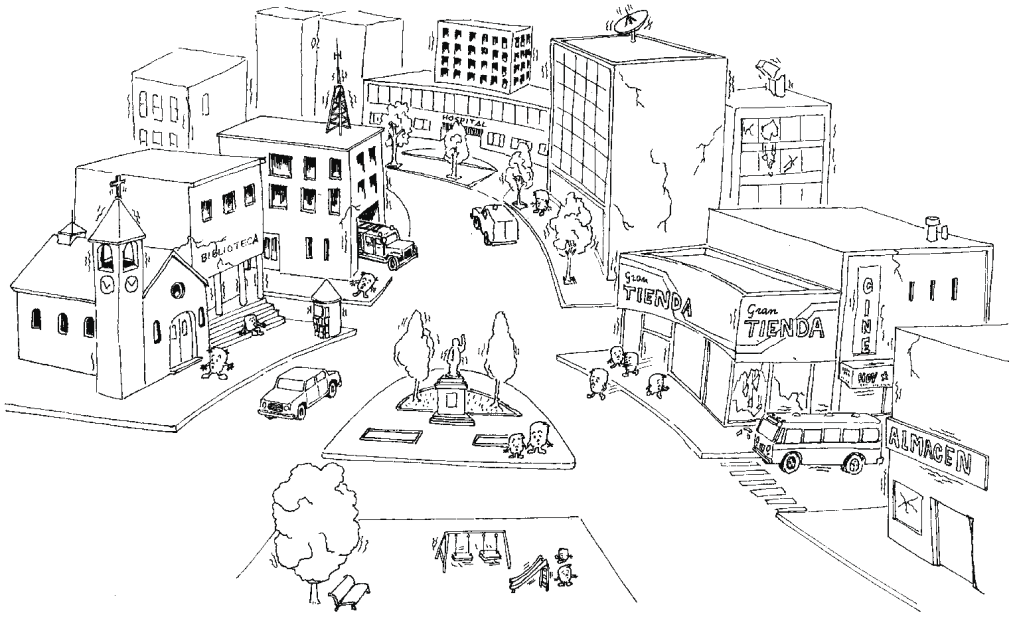


cl) Keep flashlights handy for use if disaster occurs at night.

e) Keep an adequate supply of water and food for emergency use.

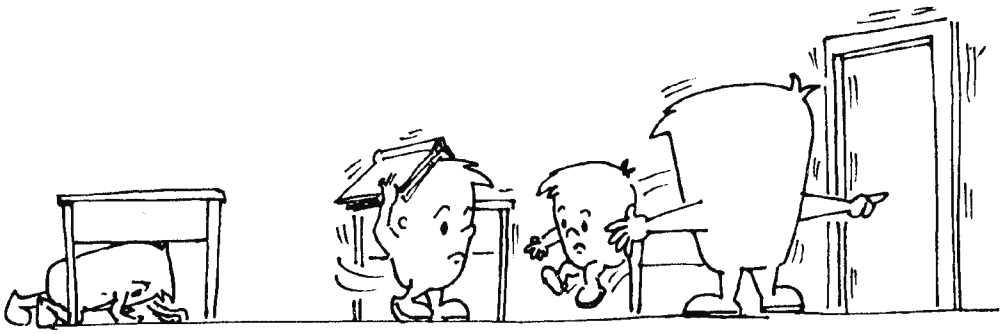
f) The individual is the final judge as to the most appropriate action for their situation. Each person should have clear in their mind an earthquake action plan, for both self and family, which covers normal situations.

g) Finally, during the actual earthquake keep calm, react properly and DO NOT PANIC.



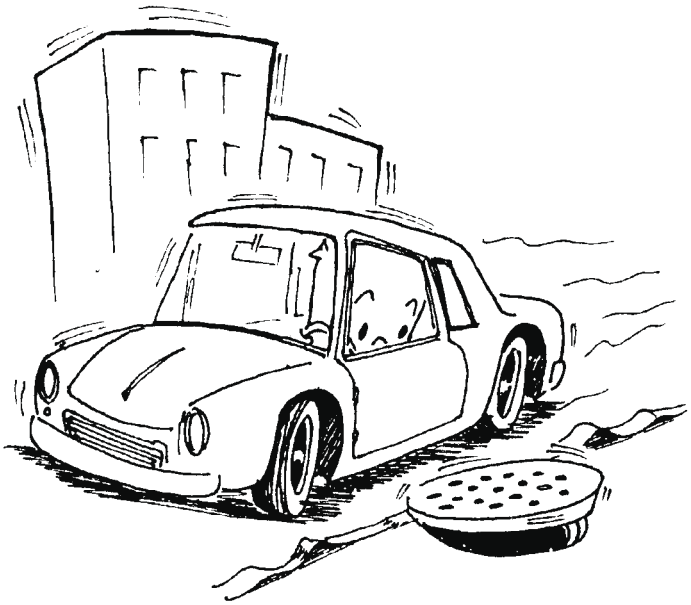
6.2.3 Actions to take if you are at the school.

if an earthquake should strike while you are in the classroom, get under the desk. Listen carefully to the teacher's directions. Put something over your head and without pushing file quietly out into the playground. When you have reached the evacuation area, line up and wait for further instructions.



6.2.4 If you are driving.

In a violent earthquake it is very difficult to control a moving car. The driver should slow down, pull over to the side of the road or street and stop the car. Avoid overpasses or power lines. Remain inside until the shaking is over, it will provide you with some cover.



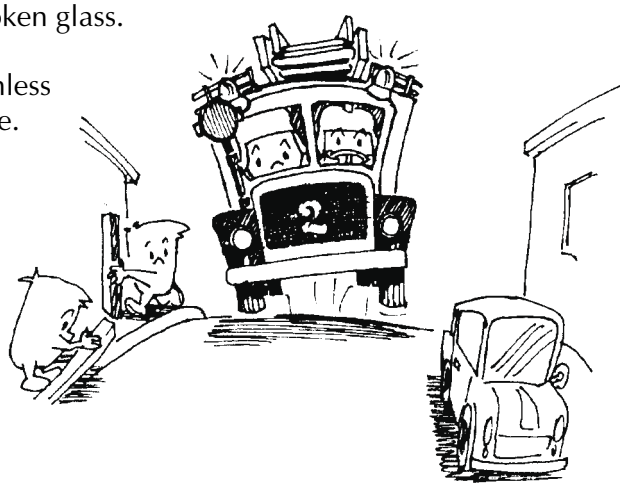
6.3 WHAT TO DO AFTER THE SHAKING STOPS

STAY CALM!

- It is possible that the shaking was just part of the process and that more aftershocks or an earthquake of even greater intensity could follow.
- Check for injuries. Give first aid to those who need it. Do not move seriously injured individuals unless they are in immediate danger.
- Douse all fires and do not use matches, candles, etc., because of possible gas leaks.
- If you smell gas, open windows and shut off the main valve, then leave the building.

Hunt for hazards:

- Check for gas and water leaks, broken electrical wiring or sewage lines. if there is damage, turn the utility off at the source.
- Check the building (including roof, chimneys and foundation) for cracks and damage.
- Check food and water supplies. Emergency water may be obtained from water heaters, melted ice cubes, toilet tanks and canned vegetables.
- Purify water by straining through a paper towel or several layers of clean cloth and then boiling it vigorously for six minutes.
- Do not eat nor drink from open receptacles located near broken glass.
- Do not use the telephone unless there is a severe injury or fire.
- Turn on your portable radio for instructions and news reports.
- Do not use your vehicle unless there is an emergency. Keep the street clear for emergency vehicles.

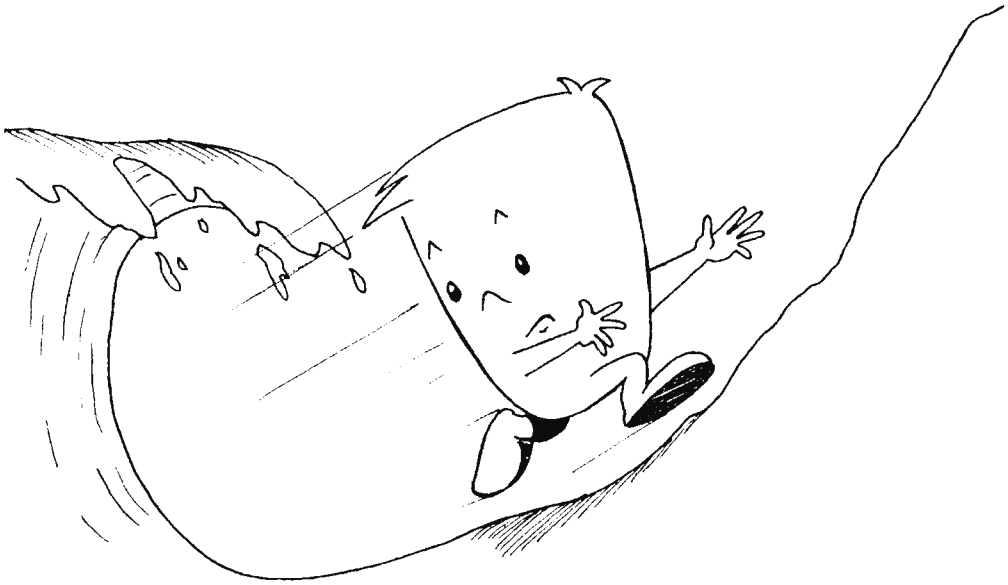


Be prepared for aftershocks. Although they are commonly smaller than the main shock, some of them could be large enough to produce aditional damage.

If you are not directly affected by the earthquake, do not try to get into the affected area. You will not be welcomed by people in the area.

6.4 WHAT TO DO IN CASE OF A TSUNAMI

A major earthquake whose epicenter is under the ocean may produce vertical displacements of the ocean floor that generate tsunami waves. The height of a tsunami at the coastline depends on the following factors: magnitude of vertical displacements, distance from the epicenter and shape of the shoreline.



6.4.1 Tsunami safety rules.

a) All earthquakes do not cause tsunamis, but many do. When you hear that an earthquake has occurrred, stand by for a tsunami emergency.

b) An earthquake in your area is a natural tsunami warning. Do not stay in low-lying coastal areas after a strong earthquake has been felt.

c) A tsunami is not a single wave, but a series of waves. Stay out of danger areas until an "all clear" is issued by competent authority.

d) Approaching tsunamis are sometimes preceeded by a noticeable rise or fall of sea level. This is nature's tsunami warning and should be heeded.

e) A small tsunami at one point on the shore can be extremely large a few kilometers away. Don't let the modest size of one make you lose respect for all.

0 The Pacific Tsunami Warning Center does not issue false alarms. When a warning is issued, a tsunami exists. The tsunami of May 1960 killed 61 people in Hilo, Hawaii, and they thought it was "just another false alarm."

g) All tsunamis - like hurricanes - are potentially dangerous, even though they may not damage every coastline they strike.

h) Never go down to the shore to watch for a tsunami. When you can see the wave you are too close to escape it.

i) Sooner or later, tsunamis visit every coastline in the Pacific. Warnings apply to you if you live in any Pacific coastal area.

j) During a tsunami emergency, your local civil defense, police, and other emergency organizations will try to save your life. Give them your fullest co-operation.

A) REPORT

EARTHQUAKE
Prelude to the Big One?

By Thomas Y. Canby (Extracted from "National Geographic, Vol. 117, Nº 5, MAY 1990")

Like thousands of other good Californians, Lee and Terry Peterson had gone to the third game of the World Series that evening, to see the Giants try to bounce back against Oakland at Candlestick Park. Far south of the park the Peterson's new frame home, their pride and joy, clung to a shoulder of the Santa Cruz Mountains, near a dark peak named Loma Prieta.

Eighteen kilometers beneath that home and peak another contest was playing, in an arena known as the San Andreas Fault. Here two enormous plates of earth's crust had been locked in a planetary pushing match since the great San Francisco earthquake of 1906. These players were tiring, reaching the breaking point. Their game was in the last inning.

The Peterson's found their seats at Cantlestick park. Expectantly ther watched the teams warm up. The clock hans reached 5:04.

Deep beneath the Petersons mountain home a section of weak rocks snapped. The two sides of the San Andreas shot past each other. Simultaneously the west side of the fault rose, lifting the mountains themselves.

The ripping was unstoppable. For about eights seconds earth's crust unzipped at more than two kilometers a second, 20 kilometers to the north and south. The bucking Santa Cruz Mountains flicked the Peterson house off its foundation, cracking it like an eggshell.

The faulting released a frenzy of seismic waves. They set seismometer needles scribbling around the world and carried a lethal message to Californians.

Waves rolling to the south bludgeoned the city of Santa Cruz, only 16 kilometers from the epicenter. They took out its commercial heart and snuffed four lives.

The waves smashed into Watsonville, damaging or destroying most homes and turning Main Street into a ghost town. They mutilated Hollister and churned the rich sediments of the Salinas Valley.

Waves rolling north roiled the ground beneath picturesque Los gatos, shattering Victorian houses and half the business district. They shook San Jose, but most building held. The waves swept up the peninsula, rattling securely planted cities such as Palo Alto and Menlo Park. At Stanford University they found old, brittle structures and tewisted and cracked them.

Ahead lay Candlestick Park, packed with 62,000 fans and ripe for disaster. The waves shook the Petersons and other bewildered spectators. But Candlestick sits on bedrock, and it defeated the waves.

Now the waves were weakining. With little effect they jiggled southern San Francisco and towns accross the bay.

A tiring vanguard of waves reached San Francisco's old Market Street area and Marina district and Oackland's busy waterfront. These areas sit on man-made fill. Here the waves found soil in tune with their own vibrations ans strummed it like a guitar string.

More waves arrived and pumped in more energy. The earth grew alive and danced.

The vibration flowed upward into buildibgs and highway structures. Picking up the rhythm, soil and structures swayed to the strenghthening beat like partners in a dance.

Marina buildings buckled; many fell. Column joints supporting Oaklands's Interstate 880 failed, and 44 slabs of concrete deck, each weighing 600 tons, collapsed on cars below. The waves pushed the Oakland end of the Bay Bridge 18 centimeters to the east, an a 15-meter section crashed onto the level beneath.

Within 15 seconds the vibrations faded. But 63 persons lay dead or dying. Some 3,800 others suffered injuries requiring medical attention. The waves damaged more than 24,000 houses and apartment buildings as well as nearly 4,000 businesses. At least a thousand structures faced demolition.

Measured in adjusted dollars, property damage approached that of the dreadful temblor of 1906, which unleashed 60 times as much energy. The Loma Prieta damage exceeded that inflicted by Hurricane Hugo during the hours it lashed the Southeast.

Still, California had been lucky. A few more seconds of shaking could have severed a crucial joint of San Francisco's battered Embarcadero Freeway, bringing it crashing down like 1-880, and thousands more homes would have been damaged or destroyed. If bolts had not failed on the Bay Bridge, swaying trusses could have pulled down more of the vital span. If the World Series had not riveted Californians in their safe homes to watch TV or clustered them in the protective nest of Candlestick Park, who knows the tally of highway victims?.

With the many wounds, moreover, came a new sense of confidence among Californians, a belief that they are doing many things right about quakes. A few of the pluses:

The relatively low level of damage. "Keep in mind that the vast majority of bay area buildings suffered no damage," emphasized John Osteraas of Failure Analysis Associates, Inc., a Menlo Park engineering firm.

The value of preparedness. Within hours of the earthquake , shelters opened from the Marina district to Hollister. Though staffed partly by legions of spontaneous volunteers, these nerve centers had been carefully planned. Throughout the year the Red Cross, the state Office of emergency Services, and other agencies conduct rehearsals that bore fruit in the October 17 response.

The growing reliability of quake forecasts. A 1988 assessment of earthquake probabilities along the San Andreas Fault, published by the U.S. Geological Survey, had assigned the southern Santa Cruz segment the highest likelihood of slipping for northern California.

The human response. Like an opened spigot, the quake released an untapped flood of caring and kindness. Volunteers materialized as if from the shaking earth, directing traffic on darkened streets, comforting the terrified with a word and a hug, extricating the injured and the dead.

B) CHAPTER SUMMARY

- Earthquakes cannot be predicted. We must prepared ourselves by knowing what is expected to happen and by knowing what to do before the earthquake in order to minimize lose of life and damage to property.
- Hazards most likely to occur are: collapse of buildings, injures due to failling objects, fires, electrocution, and gas explosions.
- Actions to take to minimize risk are: know the safe spots, know the danger spots, practice drills, learn first aid and cardiopulmonary resuscitation, keep a list of emergency numbers, learn how to shut off gas, water and electricity.
- Do not panic during the shaking of the earthquake.
- Open space is the safest location during a strong earthquake.
- If access to the open is not immediately available, seek shelter under strong objects.
- Do not use elevators during the earthquake.
- If driving a car, slow down and pull over to the side of the road or street and stop the car.
- Beware of the aftershocks.
- After the earthquake hunt for hazards like gas or water leaks, fires, cracks and building damage.
- Turn on your portable radio for news reports and instructions.
- If you live near the coastline be prepared to follow the tsunami safety rules.

C) QUESTIONS/PROBLEMS

1 . Describe the hazards most likely to occur during an earthquake.

2. Name five actions to take before an earthquake occurs to minimize risk.

3. Describe the main actions to take during a strong earthquake.

4. List the DON'Ts to consider during an earthquake.

5. Describe actions to take after the earthquake stops shaking.

6. List the DON'Ts to consider after the earthquake.

7. Describe the main tsunami safety rules.

D) CHAPTER TEST

Multiple Choice. Choose and mark the letter that best completes the statement or answer the question.

1. To be safe from an earthquake one should:

   a) stay close to a window
   b) stay close to a fireplace
   c) go to open space
   d) none of the above

2. If you are at school and an earthquake occurs you should:

   a) run away
   b) get under the desk
   c) turn off electric power
   d) go to the window

3. If you are driving a car when an earthquake starts you should:

   a) blow your horn
   b) drive slowly
   c) stop the car
   d) none of the above

4. After the earthquake stops you should:

   a) go to the affected area
   b) drive quickly home
   c) turn your radio off
   d) hunt for hazards

5. If you live on the coastline and a big earthquake occurs you should:

   a) stay close to the coastline
   b) go to higher ground as soon as possible
   c) watch for aftershocks
   d) none of the above